Journal of Contemporary Educational Research, 2025, Volume 9, Issue 6
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Research on the Optimization of Digital Technology-Based Higher Education Teaching Models

Yuanwei Zhao*

Armed Police College, Chengdu 610200, Sichuan, China

Author to whom correspondence should be addressed.

Abstract: With the advancement of digital technology, new technologies such as artificial intelligence, big data, and cloud computing have gradually permeated higher education, leading to fundamental changes in teaching and learning methods. Therefore, in the process of reforming and developing higher education, it is essential to take digital technology empowering the optimization of the education industry as a breakthrough, focusing on five key areas: the construction of smart classrooms, the digital integration of teaching resources, the development of personalized learning support systems, the reform of online-offline hybrid teaching, and the intelligentization of educational management. This paper also examines the experiences, challenges, and shortcomings of typical universities in using digital technology to improve teaching quality, optimize resource allocation, and innovate teaching management models. Finally, corresponding countermeasures and suggestions are proposed to facilitate the smooth implementation of digital transformation in higher education institutions.

Keywords: Digital technology; Higher education; Teaching model optimization; Smart classroom; Hybrid teaching

Online publication: June 30, 2025

1. Introduction

Currently, the modernization of education has entered a deep-water phase, with the application of digital technology evolving from "tool usage" to "system empowerment." Universities serve as critical platforms for national talent development, and the quality of talent cultivation directly impacts national development strategies and societal progress [1]. However, traditional classroom teaching models can no longer meet the needs of talent cultivation in the new era, which demands personalization, efficiency, and intelligence. Therefore, exploring how digital technology can empower the reform and innovation of teaching models from a practical perspective is of constructive significance [2].

2. Digital technology applications in pedagogy

2.1. Main technological forms

The application of digital technology in higher education teaching has given rise to diverse technological forms, encompassing a broad spectrum from basic online teaching platforms to cutting-edge intelligent technologies. Online teaching platforms (e.g., MOOCs) have become the foundational infrastructure for higher education digitization, with over 18,000 MOOC courses available globally [3], breaking temporal and spatial constraints through asynchronous learning models. Blended learning models further integrate the advantages of online and face-to-face instruction. For example, the flipped classroom approach shifts knowledge acquisition to pre-class activities, allowing in-class time to focus on higher-order thinking skills. AI-driven personalized learning systems such as adaptive learning platforms employ machine learning algorithms to analyze learner data, enabling dynamic content recommendations and learning path adjustments. Platforms like Knewton have demonstrated a 30% improvement in learning efficiency [4]. VR/AR immersive learning environments show unique value in practice-oriented disciplines such as medicine and engineering. For instance, surgical simulation training can reduce error rates by 40% [5]. Together, these technological forms constitute a multi-layered, three-dimensional ecosystem for digital teaching and learning.

2.2. Theoretical foundations

The educational application of digital technologies is grounded in robust theoretical frameworks. Constructivist learning theory provides the core foundation for technology-enhanced learning, emphasizing learners' active knowledge construction processes in digital environments. Jonassen's [6] cognitive tools theory posits that technology should serve not merely as an information delivery medium but as scaffolding to facilitate deep thinking. Connectivism responds to the characteristics of knowledge in the digital age, with Siemens arguing that learning is a process of forming connection networks—a concept that directly inspired the design philosophy of MOOCs [3]. The sociocultural theory concept of the "zone of proximal development" has been applied in intelligent tutoring systems, where algorithms identify and support learners' potential developmental levels. Additionally, the cognitive theory of multimedia learning offers evidence-based principles for designing digital instructional resources, with effects such as segmenting and dual coding widely validated. These theories not only justify the rationale for technological applications but also guide the innovative development of educational technology [7].

2.3. Implementation models

The pedagogical implementation of digital technologies manifests in three typical models. Supplementary integration employs technology as an auxiliary tool for traditional teaching, for example, using classroom response systems (clickers) to enable real-time feedback. Research shows this model can increase student engagement by 25% [8]. Blended restructuring redesigns teaching processes holistically, as seen in Rain Classroom smart tool, which digitizes, lectures, and quizzes, tripling teacher-student interaction frequency. Disruptive innovation models radically transform educational paradigms, exemplified by fully online virtual universities, which enrolled over 300,000 students in 2023. Different models require varying levels of technological maturity, ranging from simple learning management system applications to complex Artificial Intelligence of Things educational scenarios, demonstrating a gradient of technological integration. Implementation research indicates that successful digital transformation must align with institutional faculty conditions, student characteristics, and disciplinary attributes.

3. Analysis of existing problems

3.1. Technological alienation

The application of digital technology in higher education has gradually revealed characteristics of technological alienation, where technology shifts from being an auxiliary tool to dominating the teaching process. Some universities excessively rely on intelligent systems, such as AI-based automated grading and algorithm-driven content recommendations, which weaken instructors' decision-making autonomy and trap students in passive learning. For instance, after one university adopted a smart classroom system, instructors were compelled to modify their pedagogical approaches to fit the technical framework, thereby constraining innovative teaching practices. Another manifestation is the data-centric tendency—evaluating learning outcomes through quantitative metrics, e.g., login duration, click-through rates, while neglecting the humanistic essence of education. Such phenomena reflect a misalignment between technological tools and educational objectives, warranting caution against the fallacy of technology for technology's sake.

3.2. Weakened teacher-student interaction

Digital technologies have contributed to the dehumanization of teacher-student interaction. Asynchronous teaching methods (e.g., pre-recorded lectures, forum discussions) reduce real-time feedback and emotional engagement. A 2023 survey by Beijing Normal University found that 72% of students perceived online learning as "lacking a sense of belonging," while instructors reported difficulties in interpreting students' non-verbal cues (e.g., confused expressions) through screens [8]. Furthermore, technologically mediated communication (e.g., bullet comments, chat boxes) fragments discourse, reducing in-depth discussions to simplified "likes" or brief replies. Although tools like virtual office hours and AI teaching assistants attempt to bridge this gap, their mechanistic responses cannot replace genuine human dialogue, potentially exacerbating students' academic isolation.

3.3. Widening digital divide

The uneven adoption of technology has intensified disparities across socioeconomic and regional lines in higher education. At the hardware level, universities in underdeveloped regions often struggle with outdated devices and poor internet connectivity, while affluent areas have adopted 5G and VR-based teaching. At the competency level, instructors' digital literacy varies significantly: senior faculty face challenges adapting to new platforms, while disparities exist between "digital native" students and those with limited access. For example, a survey at a university with a high rural enrollment revealed that 15% of students were forced to opt out of online courses due to a lack of smart devices. This divide not only undermines educational equity but may also perpetuate existing social inequalities [9].

3.4. Flawed evaluation systems

Digital teaching has fostered data-driven assessment models, yet their validity remains questionable. Current platforms predominantly measure learning outcomes through behavioral data (e.g., login frequency, video-watching duration), overlooking the complexity of cognitive processes (critical thinking, creativity). A study on MOOC learners found that 42% of students gamed the system by idling to inflate participation metrics. Moreover, AI-powered grading systems exhibit error rates of up to 30% in evaluating subjective assignments, exposing algorithmic limitations in contextual and affective understanding. Such reductionist approaches risk narrowing educational goals and encouraging test-taking strategies in online learning [9].

3.5. Intellectual property disputes

Tensions persist between open access to digital resources and intellectual property protection. Unauthorized commercialization of instructors' lecture videos and course materials by third-party platforms is rampant, yet China's Copyright Law ambiguously defines "online teaching resources," making legal recourse costly. Conversely, leaks of assignments and exam answers on social media escalate academic misconduct. For example, in 2022, a cyberattack on the Zhihuishu platform led to the exposure of thousands of unpublished test questions. These issues not only infringe on creators' rights but may also deter educators from sharing high-quality resources, hindering the sustainable development of digital education.

4. Optimization measures

4.1. Building smart classrooms: Innovations in teaching environments and teacher-student interaction

Creating smart classroom environments involves transforming physical spaces into intelligent and interactive venues for teaching activities, which is the foundation of smart classrooms. Facilities such as smart terminals, interactive displays, recording systems, and devices have replaced traditional blackboard-and-chalk teaching methods. For example, Fudan University and Nanjing University have implemented "smart classroom upgrade plans," equipping some teaching spaces with automatic tracking recording systems, intelligent lighting controls, and multi-screen linkage displays [3]. These smart classrooms enhance visual experiences and interaction efficiency while enabling features like live broadcasting and class playback across distant locations. To standardize smart classrooms, universities should establish unified standards, provide teacher training, and improve technical maintenance.

Unlike traditional one-way lectures, data-driven interactive teaching methods emphasize teacher-student and student-student interactions. Platforms like "Rain Classroom," "Zhihuishu," and "Chaoxing Learning" allow teachers to distribute pre-class materials, conduct in-class polls and quizzes, and adjust teaching plans based on post-class learning data. For instance, in an educational technology course at Beijing Normal University, teachers used an interactive system to address student feedback promptly, providing targeted guidance and significantly improving learning outcomes. These platforms also offer features like learning hot rankings, knowledge graphs, and personalized interventions, transforming teaching from "experience-driven" to "data-driven."

4.2. Digitalization of teaching resources: Aggregation and sharing mechanisms for high-quality content

Establishing university teaching resource platforms to integrate digital resources is a prerequisite for effective teaching. Most universities have built their own resource databases, such as Tsinghua University's "XuetangX," which shares high-quality resources across institutions. These platforms connect three user groups: teachers who upload resources, students who use them, and administrators who oversee them, facilitating communication and reducing workloads. Cross-institutional platforms like the "National Excellent Course Resource Library" and "MOOC China" enhance resource sharing, addressing shortages in underdeveloped regions [10].

Enhancing teachers' digital resource development capabilities is crucial. Teachers must acquire skills to transform teaching content into digital formats, moving from courseware creation to teaching resource design. For example, Xiamen University launched a teacher training program covering PPT design, micro-lecture production, animation creation, video editing, and interactive question design. Institutional support, such as incorporating resource development into performance evaluations, can motivate teachers to produce high-quality content.

4.3. Personalized learning systems: Pathways to tailored education

By collecting learning data and constructing student profiles, personalized teaching becomes possible. Data from learning management systems and teaching platforms—such as study duration, access frequency, quiz performance, and discussion participation—can be analyzed to create learning profiles. These profiles reveal students' preferences, weaknesses, and habits. Zhejiang University's "Smart Learning Companion" project generates such profiles for targeted interventions, helping identify at-risk students and optimize resource allocation.

AI recommendation algorithms provide personalized learning paths. For example, Smart Teaching Platform offers customized review lists, practice questions, and reading materials based on student behavior. It also includes reminders and early warnings for learning deviations, leveraging generative AI for tailored explanations and summaries. This shift from class-oriented to individual-oriented teaching embodies precision education [10].

4.4. Hybrid teaching reform: Exploring online-offline integration

The three-stage fusion model restructures courses into pre-class online learning, in-class discussions, and post-class practical tasks. For example, an economics course used a platform for pre-class videos and tasks, in-class problem-solving discussions, and post-class group projects, blending the strengths of face-to-face and digital teaching.

Hybrid teaching requires process-based evaluations, incorporating metrics like class participation, online assignments, and project work. Learning behavior weight evaluation mechanism tracks student engagement and interaction quality, providing real-time feedback for adjustments and fostering consistent learning habits.

4.5. Intelligent educational management: Data-driven governance

Unified data governance platforms integrate academic, student, and research systems, breaking down data silos. Smart campus platform centralizes data for leadership decision-making, ensuring standardized and secure data management.

Data-driven decision-making enhances teaching management. Harbin Institute of Technology's "Intelligent Academic System" predicts student difficulties and alerts teachers, enabling proactive interventions. Data analysis also refines teacher evaluations by incorporating student feedback and learning outcomes.

5. Conclusion

Digital technology has injected new momentum into higher education reform. This paper outlines six empowerment pathways: smart classrooms, resource integration, personalized learning, hybrid teaching, intelligent governance, and pedagogical dimension. Future education will prioritize student-centered, data-driven, and intelligent approaches. Universities must design top-level strategies, strengthen faculty development, and improve resource ecosystems to achieve equitable, high-quality outcomes. Digital transformation is not just a technological shift but a revolution in educational philosophy and organizational practices.

Disclosure statement

The author declares no conflict of interest.

References

[1] Ministry of Education, 2022, Long-term Development Plan for Education Informatization (2021–2035), 2022: 2–20.

[2] Li M, Wang X, 2021, The Connotation and Development Path of Smart Education. E-Education Research, 2021(3): 5–12.

[3] Class Central, 2023, MOOC Statistics Report, 2023: 1–15.

[4] Woolf BP, Lane HC, Chaudhri VK, et al., 2013, AI in Education: The Coming Revolution. Journal of Educational Technology, 45(2): 234–251.

[5] Pottle J, 2019, Virtual Reality and the Transformation of Medical Education. Future Healthcare Journal, 6(3): 181–185.

[6] Jonassen DH, 1999, Computers as Mindtools for Schools: Engaging Critical Thinking. Prentice Hall, 1999: 5–20.

[7] Zhang L, 2020, Construction and Practice of Smart Teaching Environments in Universities. China Educational Technology, 2020(4): 45–50.

[8] Song Y, 2022, Educational Data Governance: A Strategic Lever for Digital Transformation in Universities. Education and Economy, 2022(1): 23–29.

[9] Wu S, 2021, Transformation of Teaching Models for Personalized Learning in Universities. Higher Education Research, 2021(2): 76–80.

[10] Hu X, 2023, Implementation Models and Effectiveness Evaluation of Hybrid Teaching. Modern Distance Education, 2023(6): 15–22.